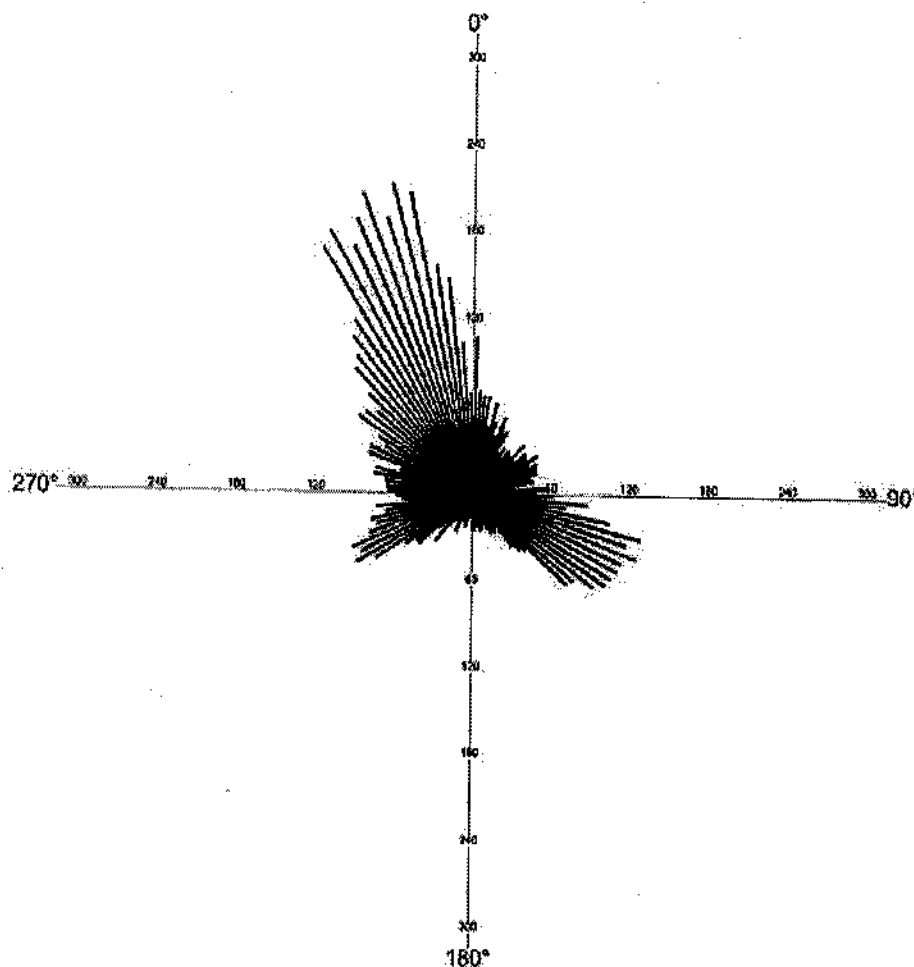


**FALL MONTHS (SEPTEMBER, OCTOBER, NOVEMBER) 1997 – SALTON CITY**

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 17.5 hours (inner circle is 17.5, outer circle is 70).

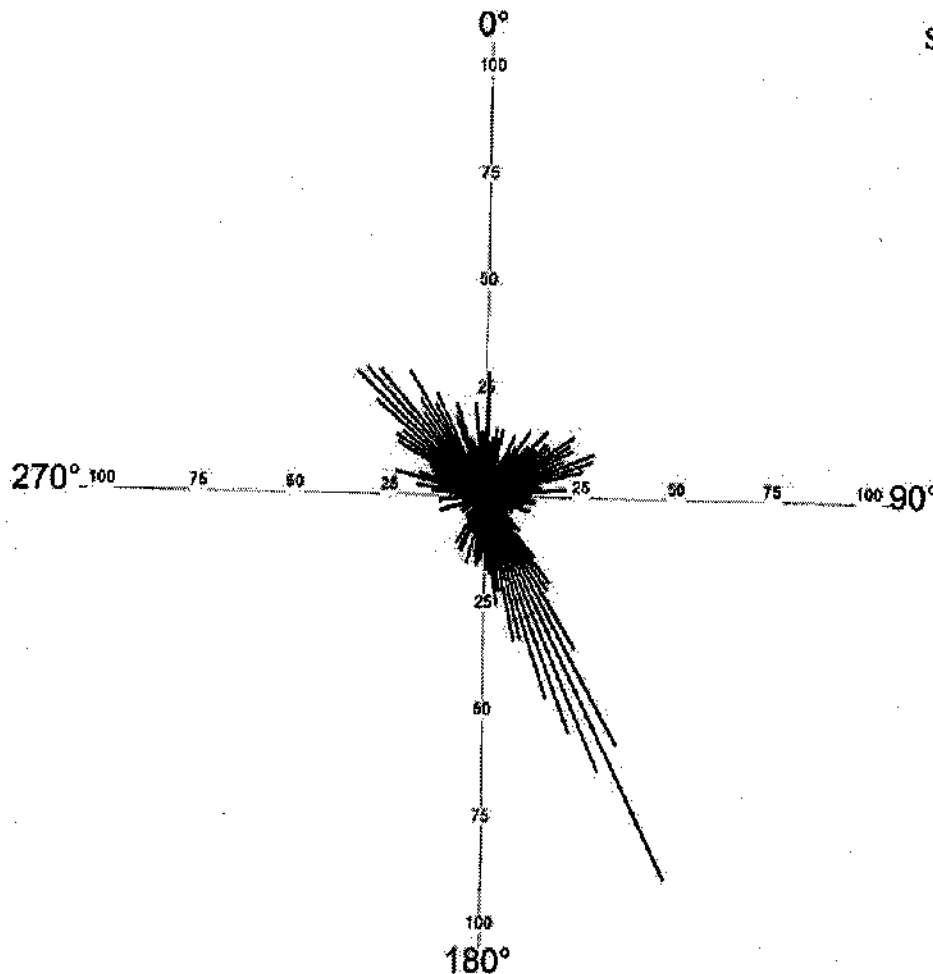
YEAR#127



### 1997 ANNUAL WIND DIRECTION DATA FOR SALTON CITY

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 60 hours (inner circle is 60, outer circle is 300).

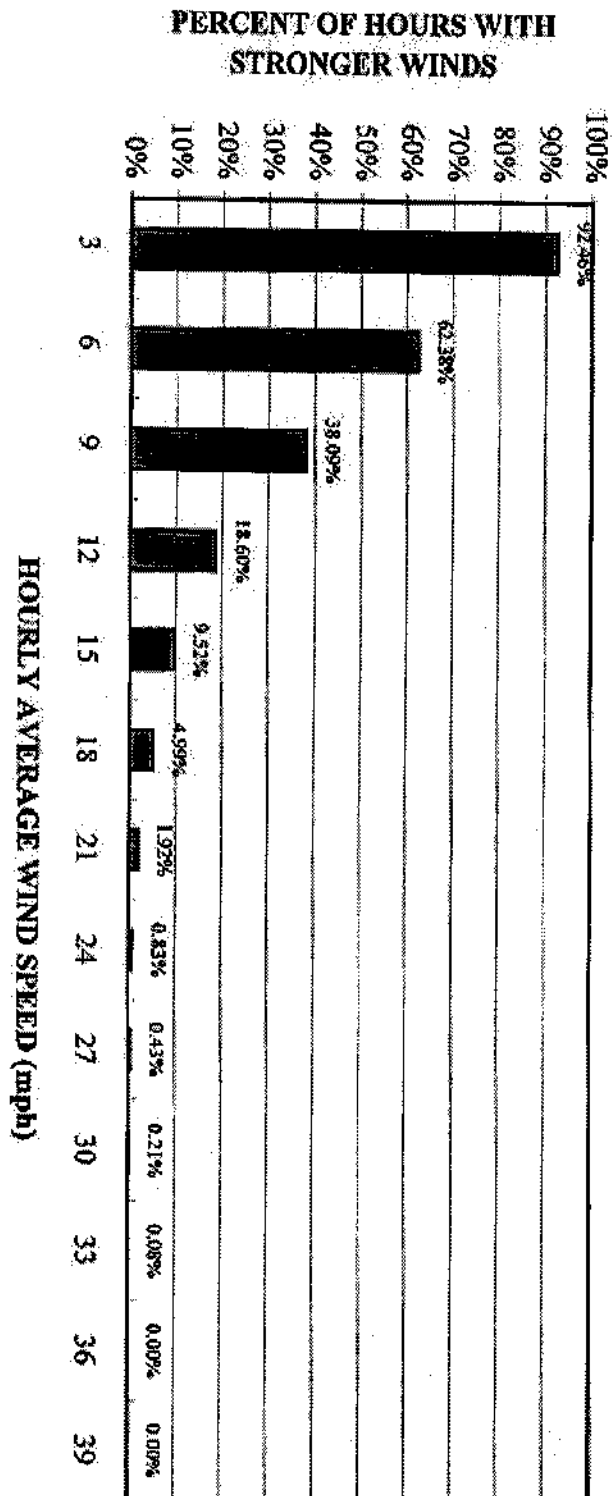
SPRG97#154



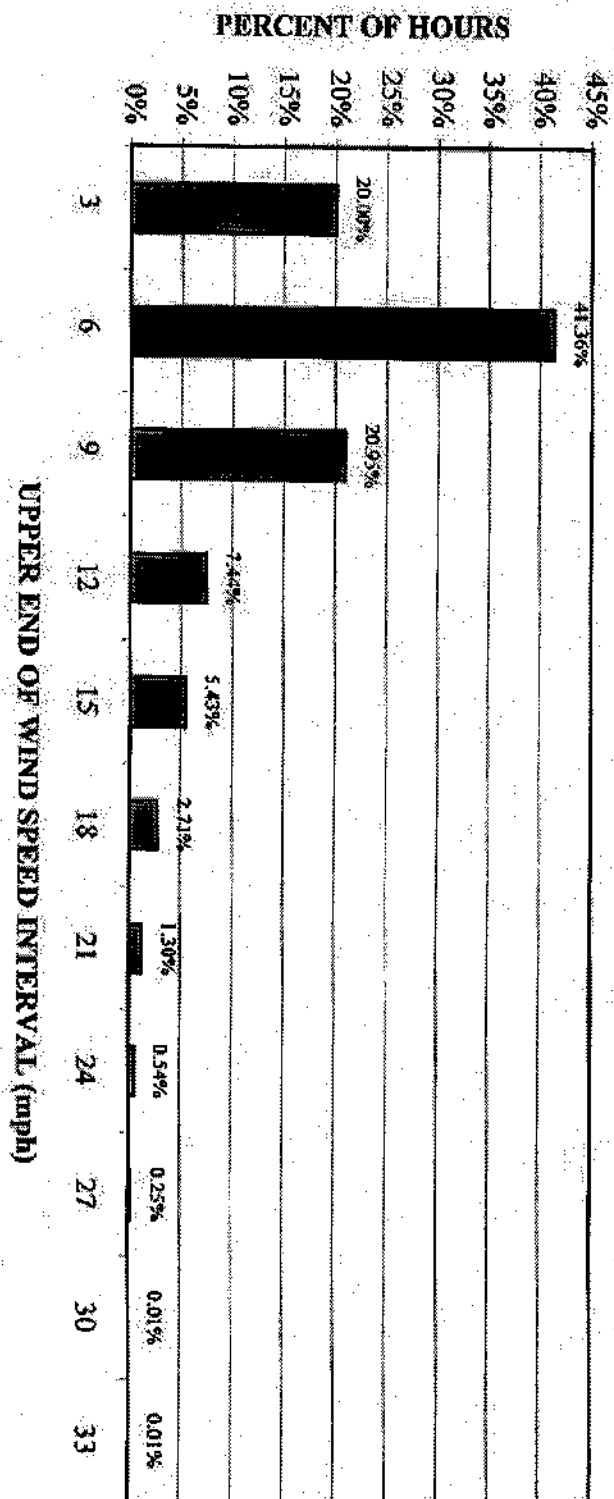
**SPRING MONTHS (MARCH, APRIL, MAY) 1997 - STATE PARK**

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 25 hours (inner circle is 25, outer circle is 100).

1997 ANNUAL DATA, SALTION CITY SITE  
CUMULATIVE WIND SPEED FREQUENCY



# 1997 ANNUAL DATA, STATE PARK SITE HOURLY WIND SPEED FREQUENCY PATTERN



## **SALTON SEA METEOROLOGICAL CONDITIONS**

### ***Temperature and Precipitation Patterns***

Average temperature conditions very similar throughout the Salton Sea Air Basin. Average daily high temperatures vary from about 71 degrees F during winter to about 105 degrees F during summer. Average daily low temperatures vary from about 40 to 45 degrees F during winter to about 70 to 75 degrees F during summer.

Annual precipitation quantities are greatest in the northern part of the Coachella Valley, and are relatively uniform and low throughout the Imperial Valley. Annual precipitation is less than 5.5 inches per year in the Palm Springs area, slightly above 3 inches per year in the Indio area, and about 2.5 inches per year throughout the Imperial Valley.

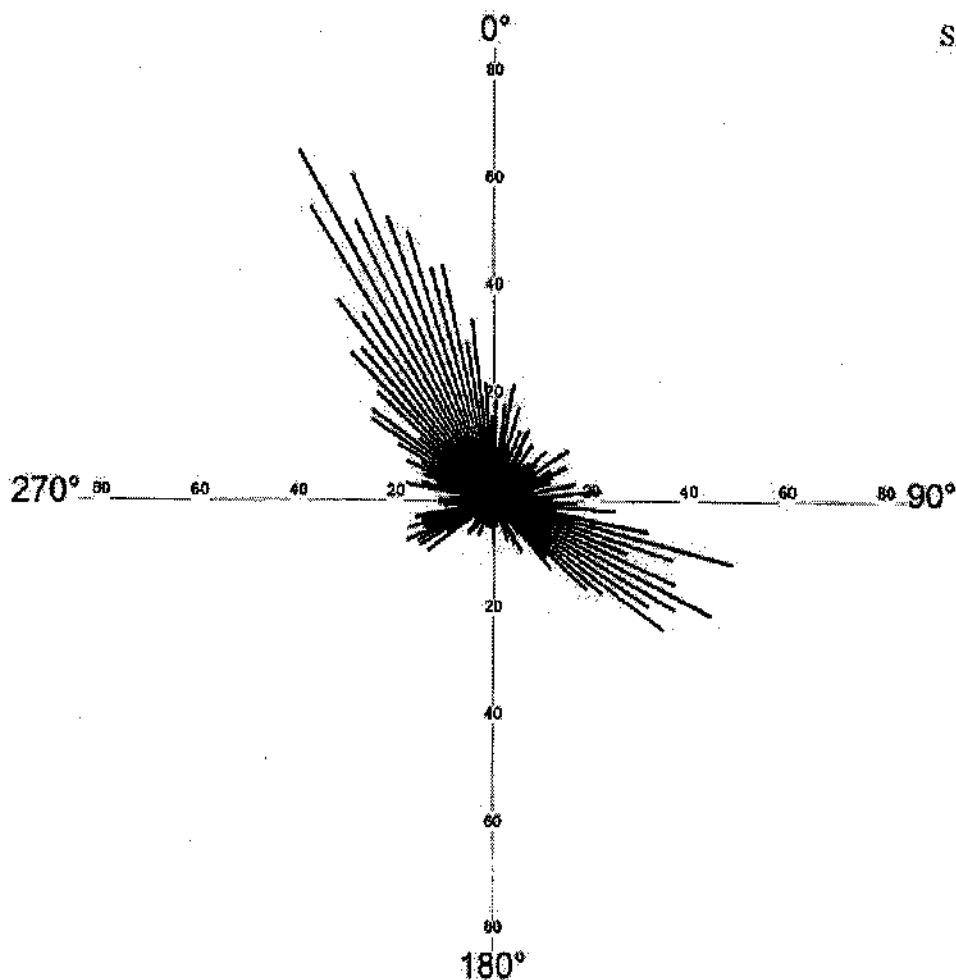
### ***Regional Wind Patterns***

An air basin perspective on wind direction patterns is provided by data for five locations in the Salton Sea Air Basin: Palm Springs, Indio, Thermal, El Centro, and Holtville (California Air Resources Board 1984). Palm Springs, Indio, and Thermal are in the Coachella Valley north of the Salton Sea. El Centro and Holtville are in the Imperial Valley south of the Salton Sea.

Wind patterns in the Coachella Valley are influenced rather strongly by topographic features. Winds in the Coachella Valley generally are oriented in a northwest-southeast alignment. The predominant winds are from the northwest at all season for Palm Springs, Indio, and Thermal. Palm Springs experiences a secondary wind component from the east-southeast during all seasons. Thermal experiences seasonably variable secondary wind components from the south-southeast and north-northeast.

Topographic influences on wind patterns are less obvious in the Imperial Valley. Predominant wind patterns at the El Centro Naval Air Facility are from the west during most of the year. During the summer, southeast winds are predominant, together with a strong secondary component from the west. Wind patterns at Holtville in the eastern part of the Imperial Valley show both southeasterly and northwesterly or westerly components at all seasons. The northwest component dominates during winter, a westerly component dominates during spring, and the southeast component dominates during the summer. Southeasterly and northwesterly components are of similar magnitudes during the fall.

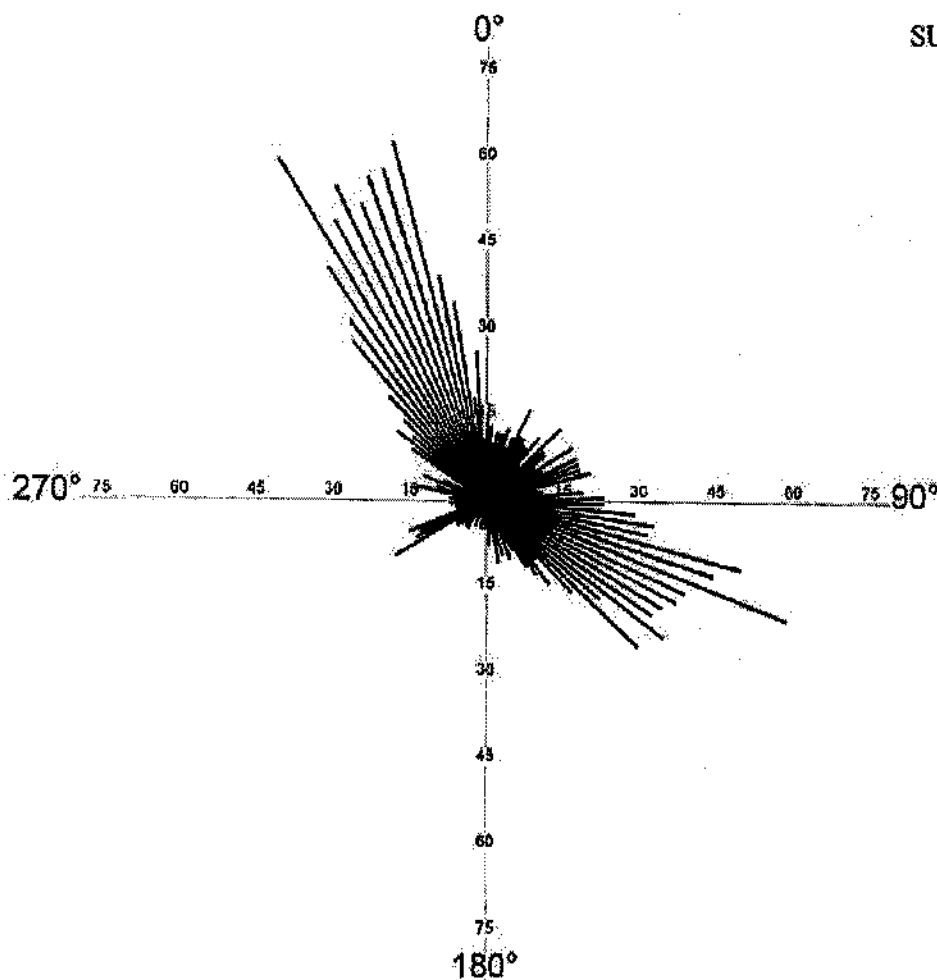
SPRG97#127



**SPRING MONTHS (MARCH, APRIL, MAY) 1997 – SALTON CITY**

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 20 hours (inner circle is 20, outer circle is 80).

SUMR97#127

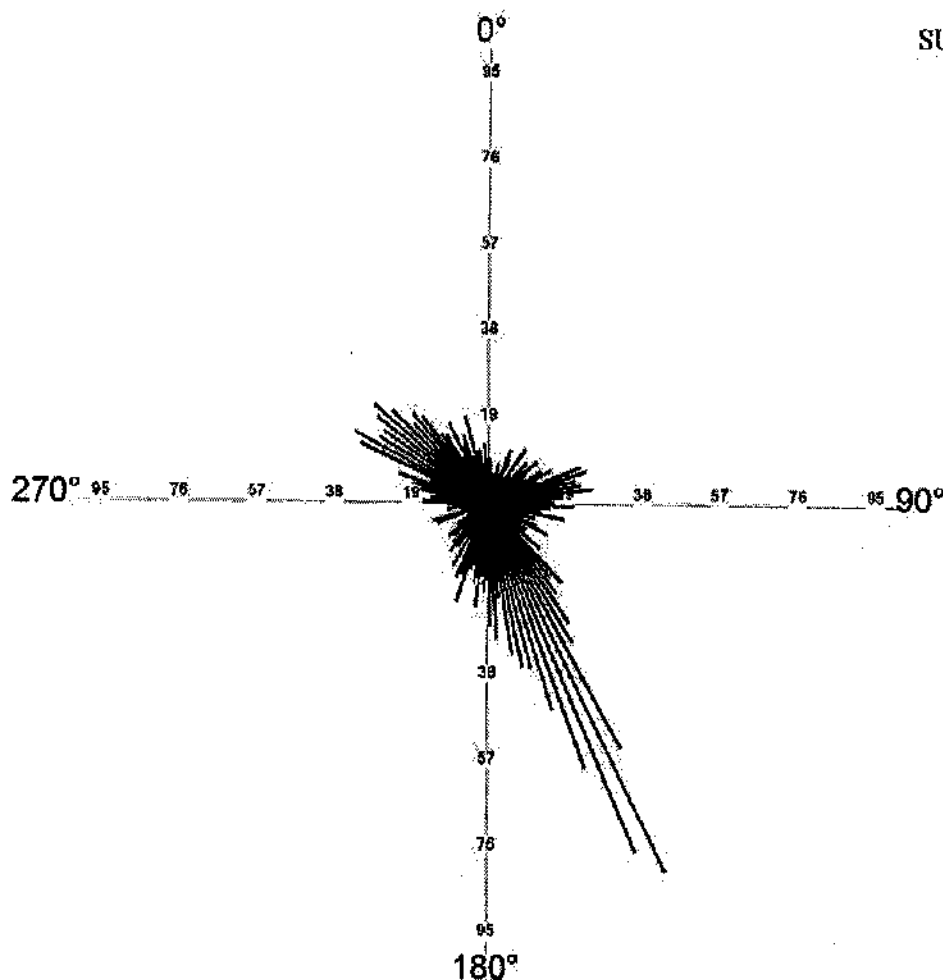


#### SUMMER MONTHS (JUNE, JULY, AUGUST) 1997 - SALTON CITY

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 15 hours (inner circle is 15, outer circle is 75).

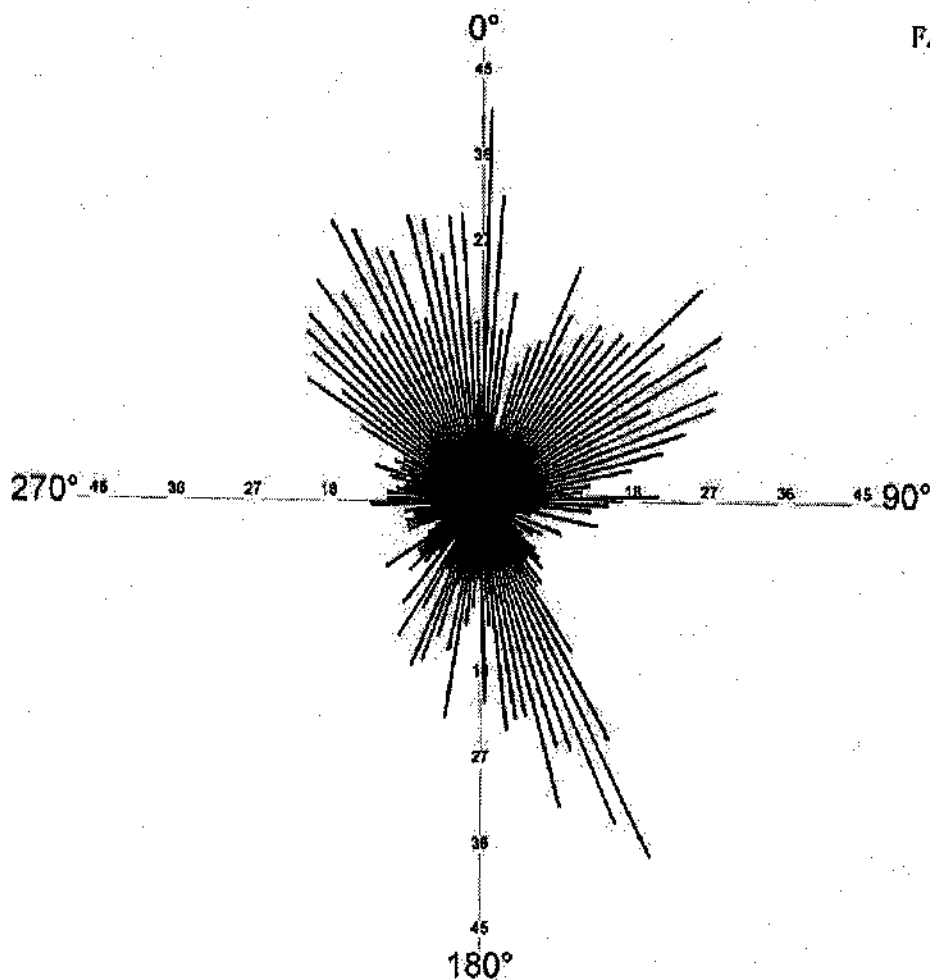


SUMR97#154



# SUMMER MONTHS (JUNE, JULY, AUGUST) 1997 – STATE PARK

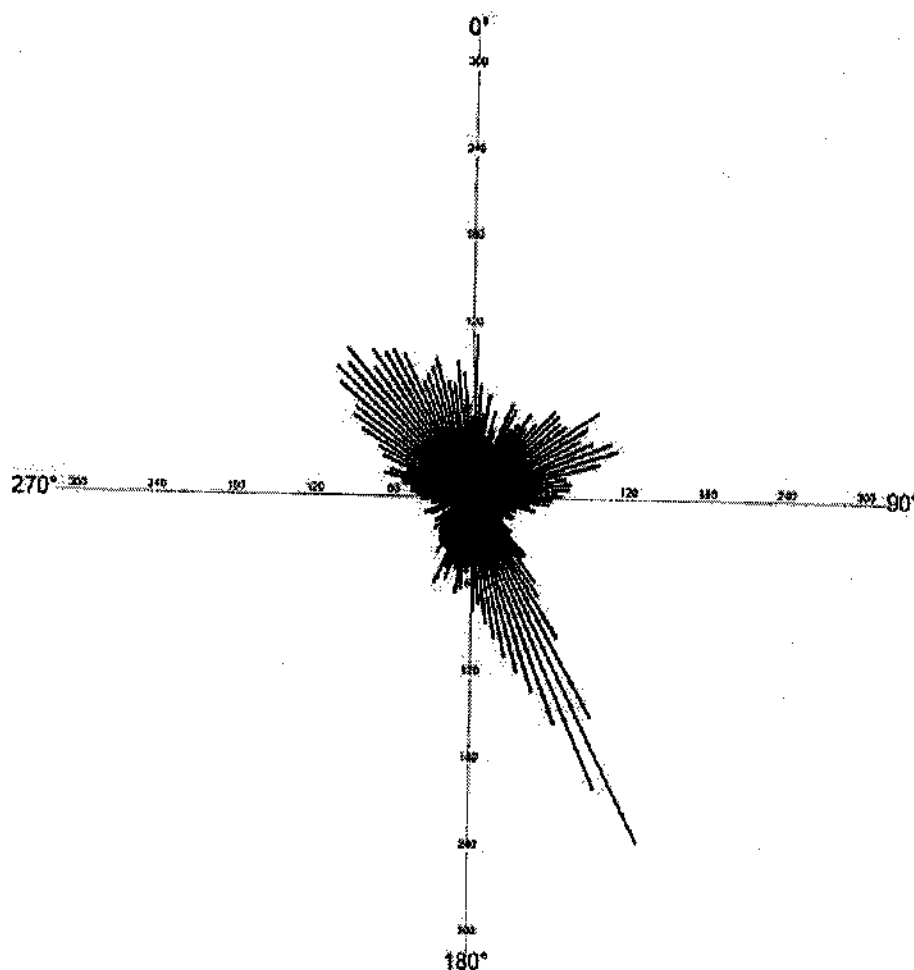
Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 19 hours (inner circle is 19, outer circle is 95).



**FALL MONTHS (SEPTEMBER, OCTOBER, NOVEMBER) 1997 - STATE PARK**

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 9 hours (inner circle is 9, outer circle is 45).

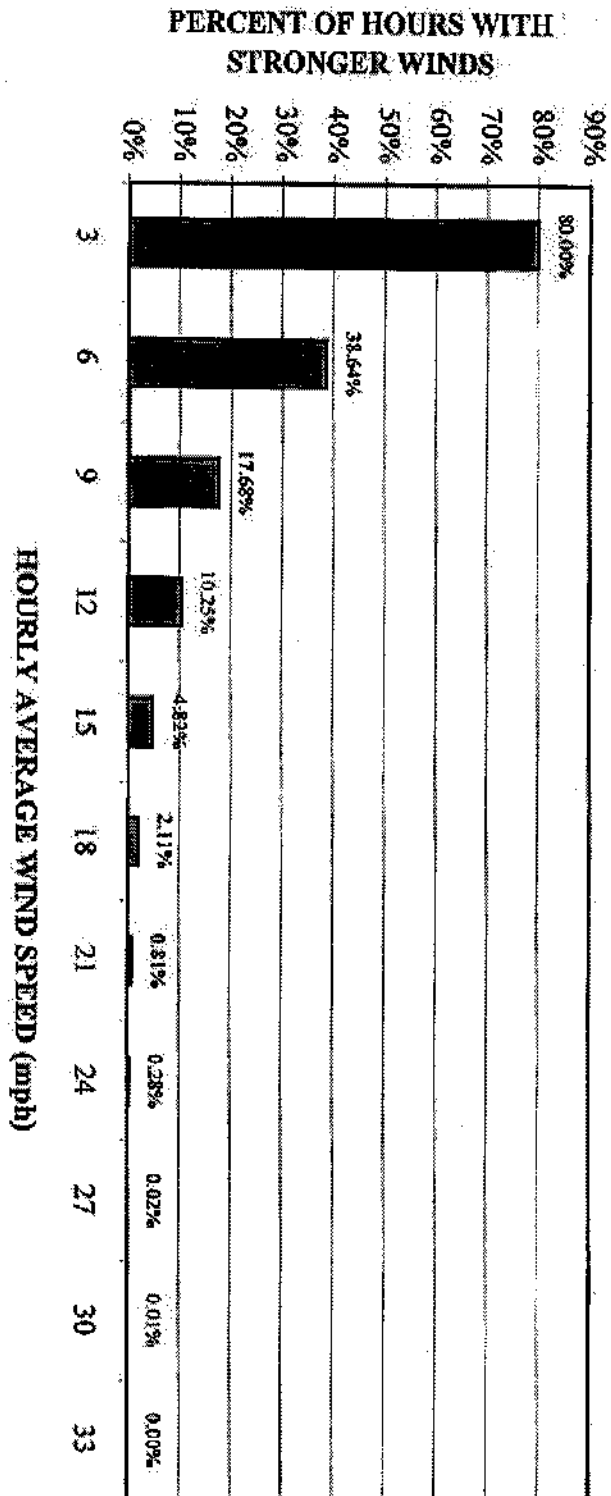
YEAR#154



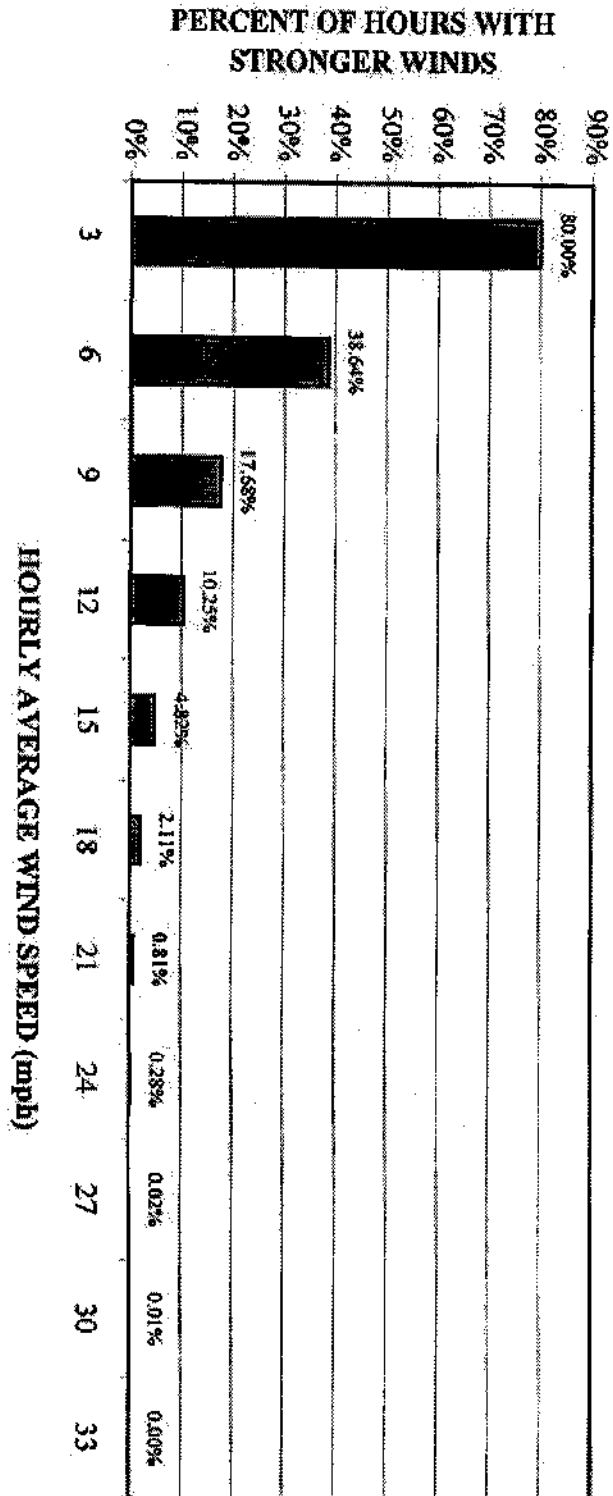
### 1997 ANNUAL WIND DIRECTION DATA FOR THE STATE RECREATION AREA

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 60 hours (inner circle is 60, outer circle is 300).

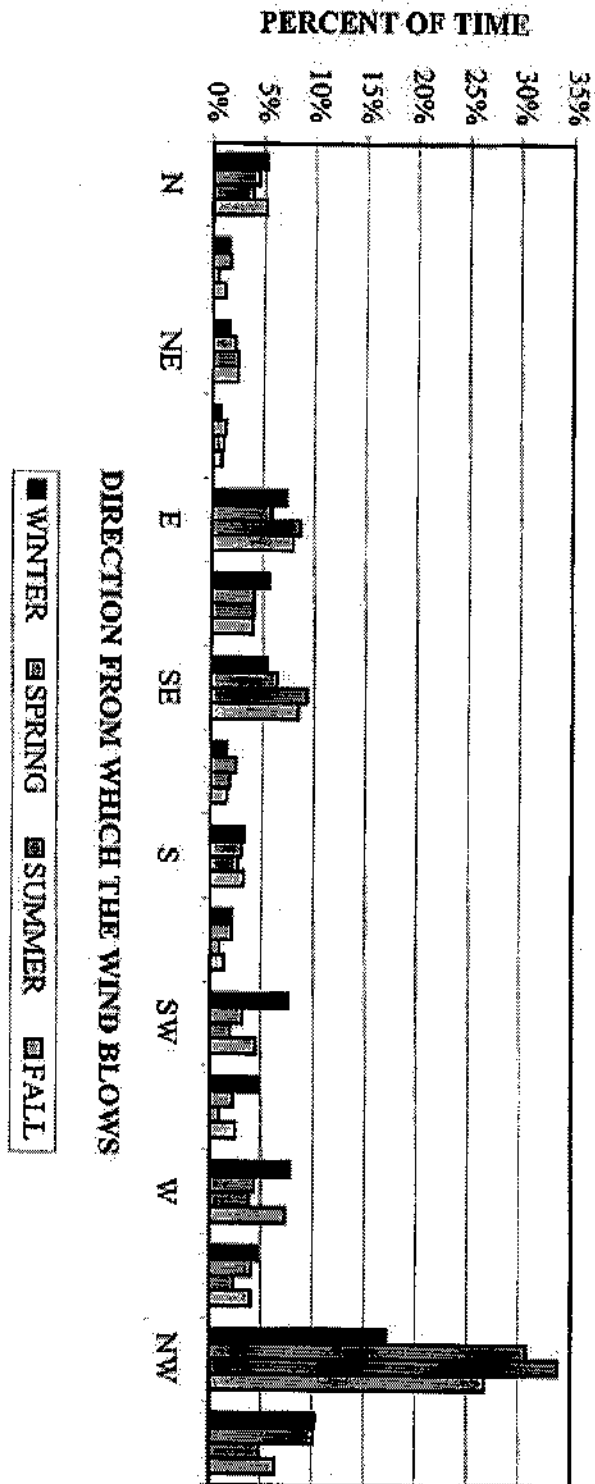
1997 ANNUAL DATA, STATE PARK SITE  
CUMULATIVE WIND SPEED FREQUENCY



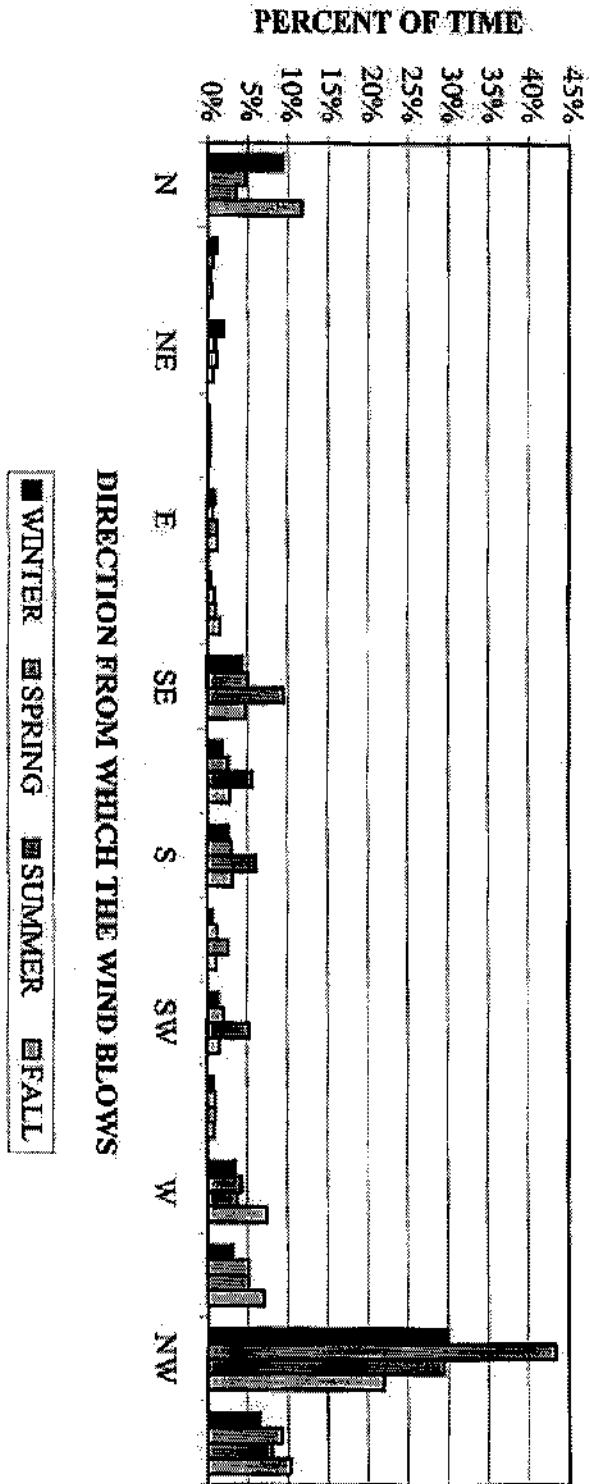
1997 ANNUAL DATA, STATE PARK SITE  
CUMULATIVE WIND SPEED FREQUENCY



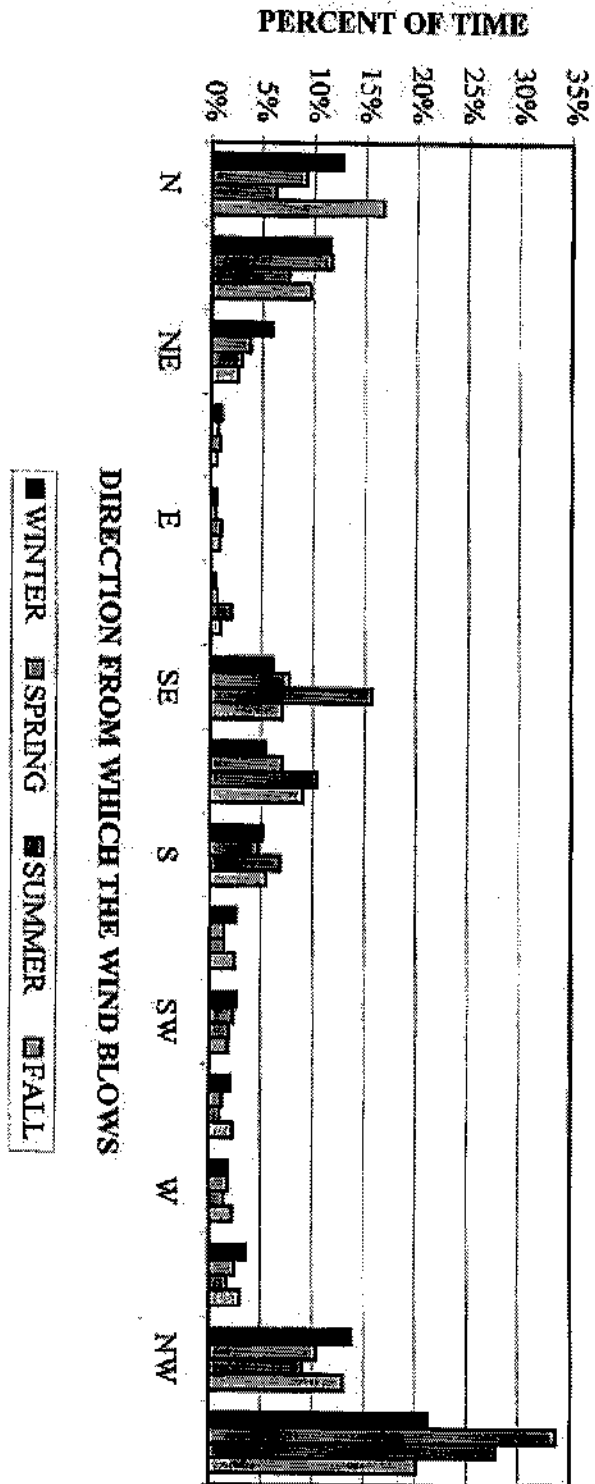
# SEASONAL WIND DIRECTION FREQUENCIES PALM SPRINGS



# SEASONAL WIND DIRECTION FREQUENCIES INDIO

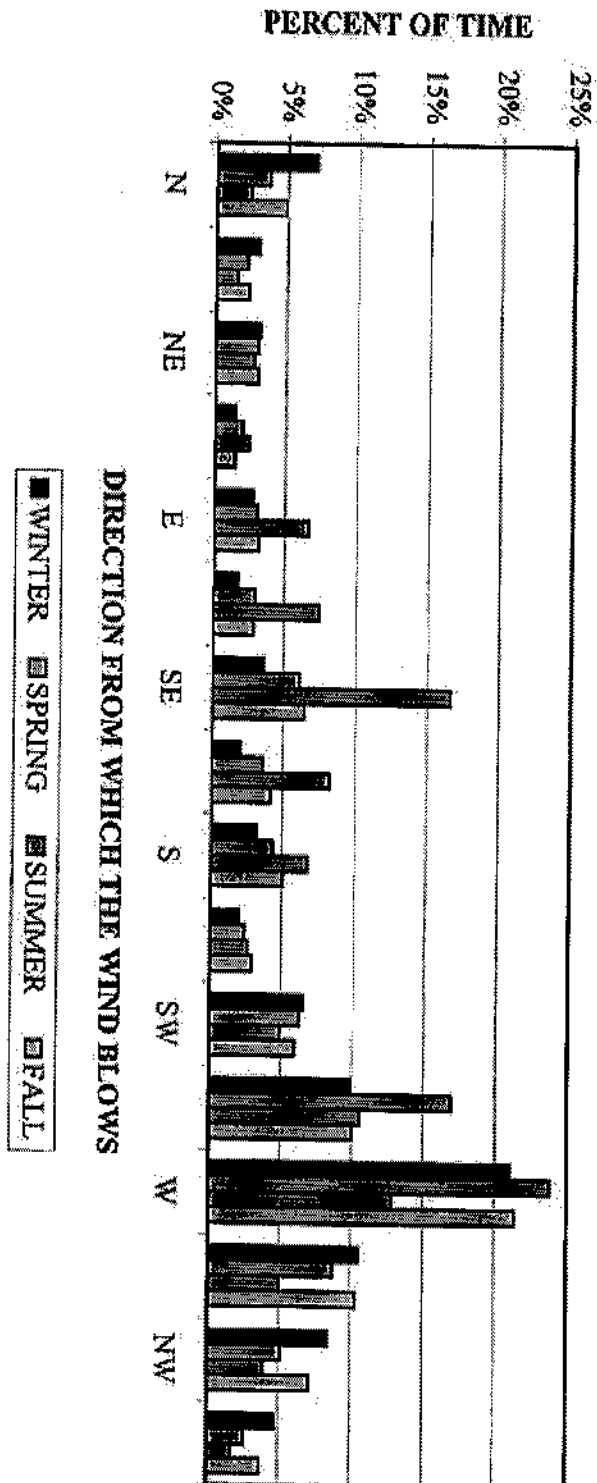


# SEASONAL WIND DIRECTION FREQUENCIES THERMAL

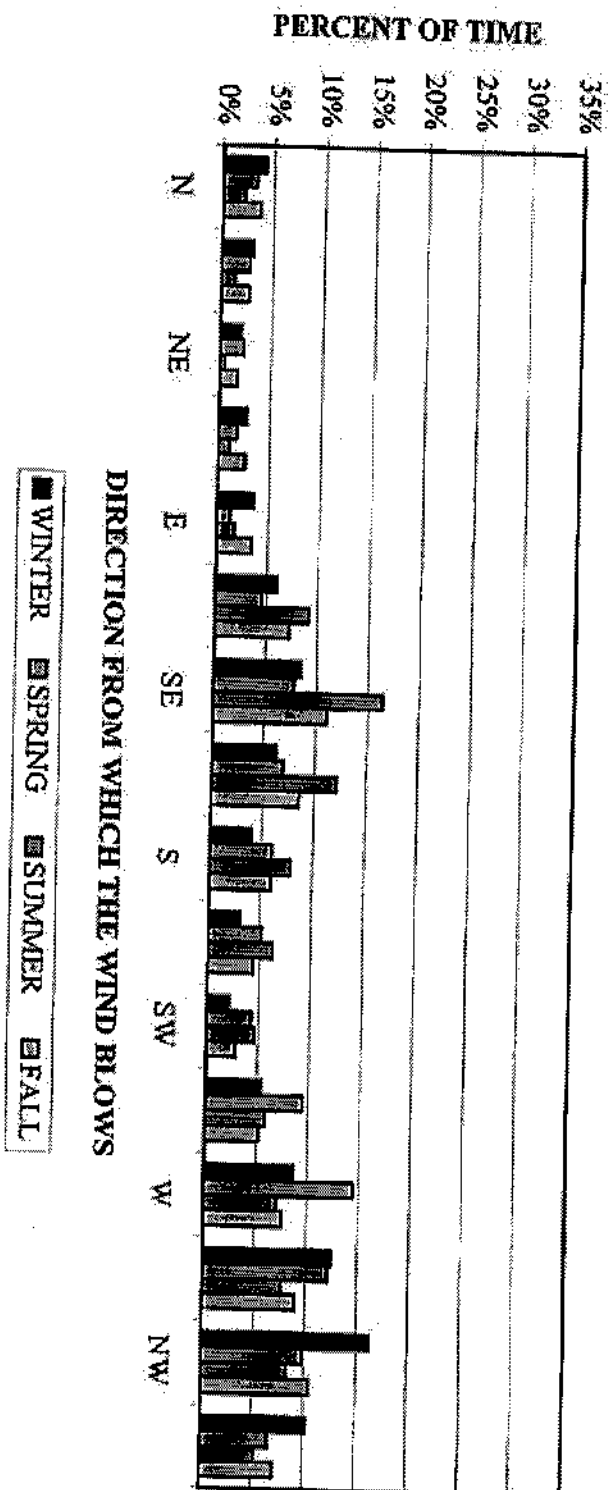




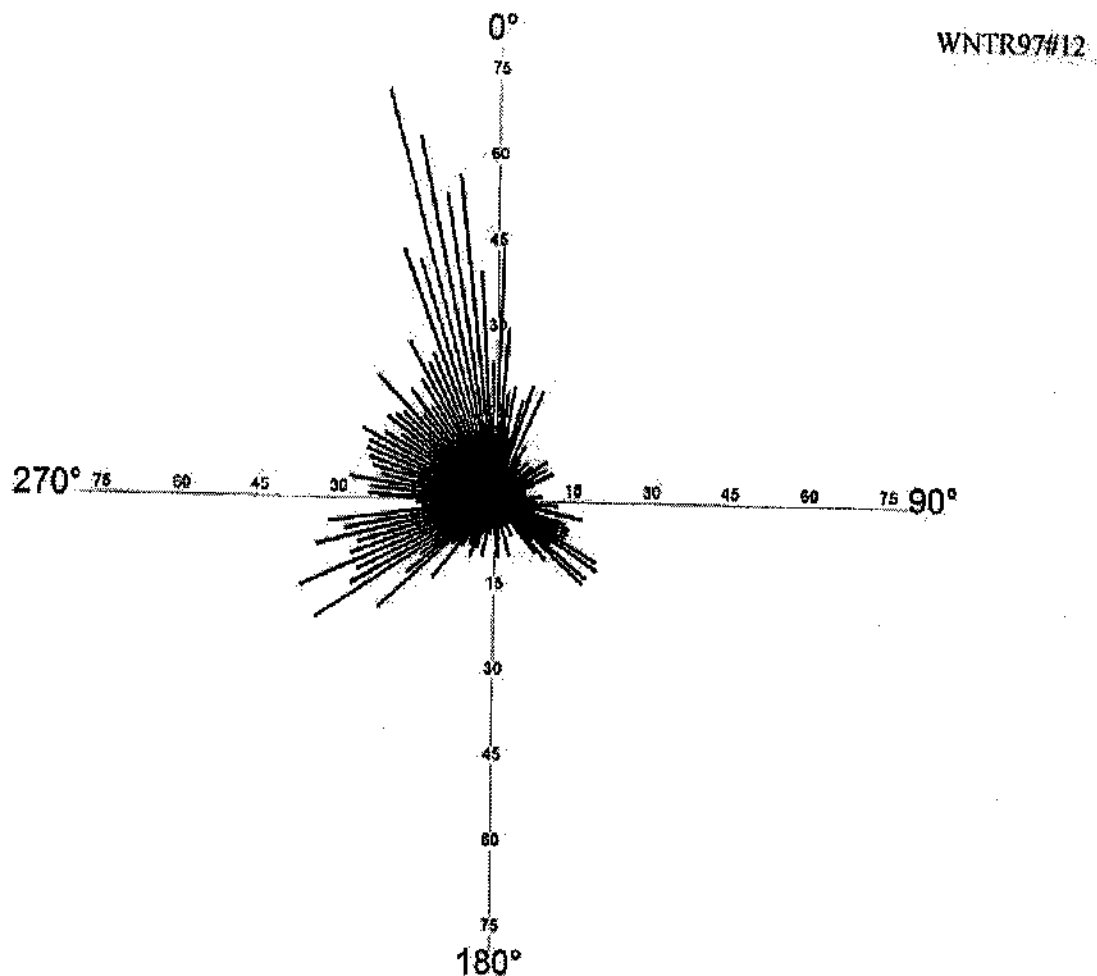
# SEASONAL WIND DIRECTION FREQUENCIES NAVAL AIR FACILITY AT EL CENTRO



# SEASONAL WIND DIRECTION FREQUENCIES HOLTVILLE



**SEASONAL WIND DIRECTIONS FOR  
CIMIS STATION #127 AT SALTON CITY, 1997**



**WINTER MONTHS (JANUARY, FEBRUARY, DECEMBER) 1997 – SALTON CITY**

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 15 hours (inner circle is 15, outer circle is 75).

### *Local Wind Patterns*

In the absence of strong frontal systems or strong gradients between high and low pressure areas which would generate a regionally dominant wind direction, winds from the Coachella Valley and Imperial Valley are likely to converge in the vicinity of the Salton Sea, creating complex airflow patterns. As a consequence of such factors, wind patterns over the southeastern part of the Salton Sea tend to differ from those over the northern part of the Sea (Cook et al., 1998).

The California Irrigation Management Information System (CIMIS) operates several meteorological monitoring stations in the Imperial and Coachella Valleys. Some of the monitoring stations are close to the Salton Sea and relatively close to facility sites associated with various restoration project alternatives. Recent data from some of these stations have been analyzed to determine wind direction and wind speed patterns. CIMIS station #127 is the monitoring site closest to the Salton Sea Test Base (enhanced evaporation system site considered in Alternatives 3, 4, and 5). CIMIS station #154 is the monitoring site closest to the Bombay Beach (enhanced evaporation system site considered in Alternative 2). Only 1997 data were available from CIMIS station #154 at the time this document was prepared. Data were available for a longer period of years from CIMIS station #127, but 1997 appeared to have the highest frequency of strong winds for the 1995 - 1998 period. Thus, the analysis focused on data for calendar year 1997.

CIMIS station #127 is located near the boat ramp on the north side of Salton City. During 1997, northwest winds were dominant during all seasons. During winter months, there was a secondary component from the west and west-southwest. During spring and summer months, winds from the east-southeast became important secondary components. Fall months showed a return to the winter directional pattern, with winds predominantly from the north-northwest through west-southwest.

CIMIS station #154 is located near the northeast corner of the Salton Sea at the headquarters of the Salton Sea State Recreation Area. During 1997, northwest and northeast winds were dominant during winter months. Southeast winds were dominant during spring and summer months. Fall months showed a transition from summer to winter directional patterns; northwest, northeast, and southeast winds all made important contributions to directional patterns during the fall.

Comparison of 1997 wind patterns for Salton City and the State Recreation Area shows that predominant wind directions are roughly aligned with the long axis of the Salton Sea. Northwest winds are dominant at Salton City, while southeast winds are dominant on the opposite shore at the State Recreation Area. Off-shore winds make a secondary contribution during fall and winter months at both locations. Direct on-shore winds were relatively infrequent at both locations. The basic wind pattern at both sites seems to be daytime valley axis winds and nighttime off-shore winds. The low frequency of direct on-shore winds may be a consequence of converging winds from the Coachella Valley and Imperial Valley, which could skew winds away from the direct on-shore direction. The low frequency of direct on-shore winds also might be a

consequence of water temperatures in the Salton Sea being too warm to generate a typical lake effect pattern of daytime on-shore winds and nighttime off-shore winds.

### *Local Wind Speed Frequencies*

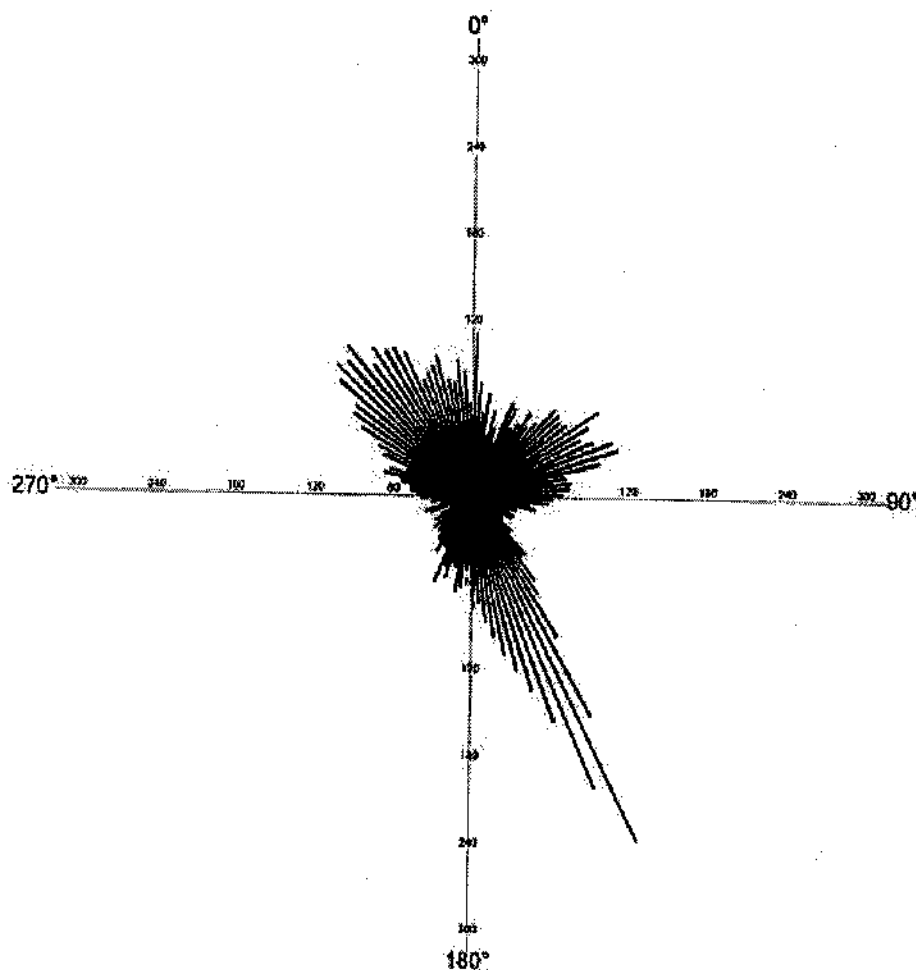
Direct comparison of wind speed data from the CIMIS stations with wind speed data from other monitoring sites is complicated somewhat by differences in instrument height. Wind speeds generally increase with height above the ground due to reduced friction effects of ground surfaces, vegetation, buildings, and other obstructions. The standard instrument height preferred by the National Weather Service is 10 meters (about 33 feet). Most CIMIS stations monitor wind conditions at a height of 2 meters (about 6.6 feet), which is more useful for assessing evaporation rates. The CIMIS station at the Salton Sea State Recreation Area (State Park site) monitors wind conditions at a height of about 5 meters (about 16 feet). To facilitate comparisons to other wind data, wind speed measurements from the CIMIS monitoring sites have been extrapolated to wind speeds at the standard 10-meter height.

Average wind speeds at the Salton City site (CIMIS station #127) were about 2 mph higher than those at the State Recreation Area site. Average wind speeds were highest during the winter, and lowest during the fall. As an annual average during 1997, wind speeds exceeded 15 mph 9.3% of the time. Wind speeds exceeded 15 mph 14.4% of the time during winter months, 7.1% of the time during spring months, 8.7% of the time during summer months, and 7.2% of the time during fall months.

Wind speeds were highest at the State Recreation Area site (CIMIS station #154) during the winter, and lowest during the fall. As an annual average during 1997, wind speeds exceeded 15 mph only 4.8% of the time. Wind speeds exceeded 15 mph 9.3% of the time during winter months, 4.4% of the time during spring months, 2.3% of the time during summer months, and 3.3% of the time during fall months.

A series of data plots relevant to the previous discussion are presented below:

- Bar chart plots of seasonal wind directions from Coachella Valley and Imperial Valley locations.
- Circular histogram plots of 1997 seasonal and annual wind directions for CIMIS stations #127 (Salton City) and #154 (State Recreation Area).
- Bar chart plots summarizing 1997 seasonal and annual wind speed frequencies for CIMIS stations #127 (Salton City) and #154 (State Recreation Area).



# **1997 ANNUAL WIND DIRECTION DATA FOR THE STATE RECREATION AREA**

Figure is a circular histogram produced by the ORIANA program using a 3 degree histogram bar width. Bar length is proportional to the count of hours for the indicated wind direction (direction from which the wind blows). Interior frequency circles are in increments of 60 hours (inner circle is 60, outer circle is 300).

# 1997 ANNUAL DATA, SALTON CITY SITE HOURLY WIND SPEED FREQUENCY PATTERN

